

Technical Publication

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Water Budget Analysis for Stormwater Treatment Area 1 West

(July 1, 2001 to June 30, 2002)

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by

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EXECUTIVE SUMMARY

Stormwater Treatment Area 1 West (STA-1W) is a constructed wetland that is part of the Everglades Construction Project mandated by Florida's Everglades Forever Act [Section 373.4592, Florida Statutes]. It was built as an expansion of the Everglades Nutrient Removal Project (ENR), a constructed wetland to demonstrate the effectiveness of phosphorus (P) removal from agricultural runoff/drainage. The ENR was operated for five years (1994 to 1999) and STA-1W started operation on July 1, 1999. STA-1W covers 2,772 hectares (6,849 acres) and is located in south Florida (26° 38' N, 80° 25' W) at the eastern edge of the Everglades Agricultural Area. The Everglades Agricultural Area is a 240,000 ha (593,000 ac), highly productive irrigation drainage basin with a major production of sugarcane. Ecological changes in the Everglades have been partially attributed to an increase in phosphorus (P) concentrations in the inflow waters. Local, state and federal initiatives have been taken to reduce P load from agricultural runoff/drainage. Water from the agricultural area flows to the south and southeast through four primary canals: Miami, North New River, Hillsboro and West Palm Beach.

A minimum of 25 percent of the P load from the EAA is required to be removed at the basin level through the application of various agricultural Best Management Practices (BMPs) (Whalen and Whalen, 1994). Further removal of P is to be achieved through constructed wetland treatment systems, known as Stormwater Treatment Areas (STAs), to an initial outflow total P concentration of 0.05 milligrams per liter (mg L^{-1}). STA-1W is one of the large-scale constructed wetlands that followed the successful operation of the ENR Project. This report presents the third annual water budget for STA-1W (July 1, 2001 to June 30, 2002). Water budget analyses for five years of the ENR Project and two years of STA-1W were reported in South Florida Water Management District technical publications (Guardo et al., 1996; Abtew and Mullen, 1997; Abtew and Downey, 1998; Abtew et al., 2000; Abtew et al., 2001).

The total inflow into STA-1W through the inflow spillway for the study period (July 1, 2001 to June 30, 2002) was 36,065 hectare-meters (ha-m) or 292,372 acre-feet (ac-ft), and the total outflow through the outflow pumps was 41,798 ha-m (338,848 ac-ft). Estimated seepage inflow from the L-7 levee through the roadside culverts was 439 ha-m (3,559 ac-ft). The seepage recirculation pump had a total flow of 1,716 ha-m (13,911 ac-ft). Total areal average rainfall for the study period was 138.1 centimeters (cm), or 54.4 inches (in), and the total areal average evapotranspiration was 133 cm (52.4 in). A comparison with the previous period's (July 1, 2000 to June 30, 2001) water budget shows that surface water inflow for this period was four times that of the last period, indicating that the 2000-2001 drought is over (Abtew et al., 2002).

The mean hydraulic loading rate for the study period, based on daily average inflow, was 3.56 centimeters per day (cm d^{-1}), or 1.4 inches per day (in d^{-1}). The mean hydraulic retention time was computed as the ratio of the mean estimated volume of STA-1W and the average of inflow and outflow. The mean estimated volume was computed from the area-weighted (by cell) mean depth of 62 cm (24.4 in) and total area of 2,772 ha (6,849 ac). The estimated mean hydraulic retention time was 16.1 days and that is the lowest for the three years of STA-1W operation.

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LIST OF ABBREVIATIONS AND ACRONYMS

ac	acre
ac-ft	acre-foot
BMP	Best Management Practices
cm	centimeter
cm d ⁻¹	centimeter per day
cfs	cubic foot per second
EAA	Everglades Agricultural Area
ENR	Everglades Nutrient Removal
ET	evapotranspiration
ft	foot
ha	hectare
ha-m	hectare-meter
HW	headwater
in	inch
in d ⁻¹	inch per day
m	meter
m ³ s ⁻¹	cubic meter per second
MAX	maximum
MIN	minimum
mm	millimeter
NGVD	National Geodetic Vertical Datum
P	phosphorus
Q	discharge
rpm	revolution per minute
SFWMD	South Florida Water Management District
STA	Stormwater Treatment Area
TW	tailwater
UVM	ultrasonic velocity meter
WCA	Water Conservation Area

CONVERSION FACTORS

METRIC	ENGLISH
mm	0.03937 in
cm	0.3937 in
m	3.2808 ft
ha	2.47 ac
m ³ s ⁻¹	35.33 cfs
ha-m	8.1068 ac-ft

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INTRODUCTION

Background

Stormwater Treatment Area 1 West (STA-1W) is a constructed wetland that is part of the Everglades Construction Project mandated by Florida's Everglades Forever Act [Section 373.4592, Florida Statutes]. It was built as an expansion of the Everglades Nutrient Removal Project (ENR), a constructed wetland to demonstrate the effectiveness of phosphorus (P) reduction from agricultural runoff/drainage. The ENR was operated for five years (1994 to 1999), and STA-1W started operation on July 1, 1999. STA-1W covers 2,772 hectares (6,849 acres) and is located in South Florida (26° 38' N, 80° 25' W) at the eastern edge of the Everglades Agricultural Area (Figure 1). The Everglades Agricultural Area is a 240,000 ha (593,000 ac), highly productive basin with a major production of sugarcane. Ecological changes in the Everglades have been partially attributed to an increase in phosphorus (P) concentrations in the inflow waters. Local, state and federal initiatives have been taken to reduce P load from agricultural runoff/drainage. Agricultural runoff/drainage from the agricultural area flows to the south and southeast through four primary canals, shown in Figure 1: Miami, North New River, Hillsboro and West Palm Beach.

A minimum of 25 percent of the P load from the EAA is required to be removed at the basin level through the application of various agricultural Best Management Practices (BMPs) (Whalen and Whalen, 1994). Further removal of P is to be achieved through constructed wetland treatment systems, known as Stormwater Treatment Areas (STAs), to an initial outflow total P concentration of 0.05 milligrams per liter (mg L^{-1}). STA-1W is one of the large-scale constructed wetlands that followed the successful operation of the ENR Project. This report presents the third annual water budget for STA-1W (July 1, 2001 to June 30, 2002). Water budget analyses for five years of the ENR Project and two years of STA-1W were reported in South Florida Water Management District technical publications (Guardo et al., 1996; Abtew and Mullen, 1997; Abtew and Downey, 1998; Abtew et al., 2000; Abtew et al., 2001).

Site Description

A survey of the ENR Project indicated that the area is primarily covered by Okeechobee muck soils where one to two meters of peat overlies several meters of carbonate rock (Jammal and Associates, Inc., 1991). The topography of STA-1W is relatively flat, with an average ground elevation of 2.99 m (9.79 ft) NGVD. To the east, the L-7 levee separates STA-1W from the Arthur R. Marshall Loxahatchee National Wildlife Refuge (Water Conservation Area 1, WCA-1). The seepage canal runs along the northern perimeter; the discharge canal on the west separates STA-1W from agricultural land. The narrow southern ENR levee separates STA-1W from the discharge area into WCA-1. STA-1W consists of five cells (Cells 1, 2, 3, 4 and 5). Cell 1 and Cell 3, and Cell 2 and Cell 4 are two parallel treatment trains of pairs of cells from the previous ENR. As shown in Figure 2, the largest cell, Cell 5, has been added to the north. The total area of STA-1W is 2,772 ha (6,849 acres). Table 1 depicts the area and average ground elevation for each cell.

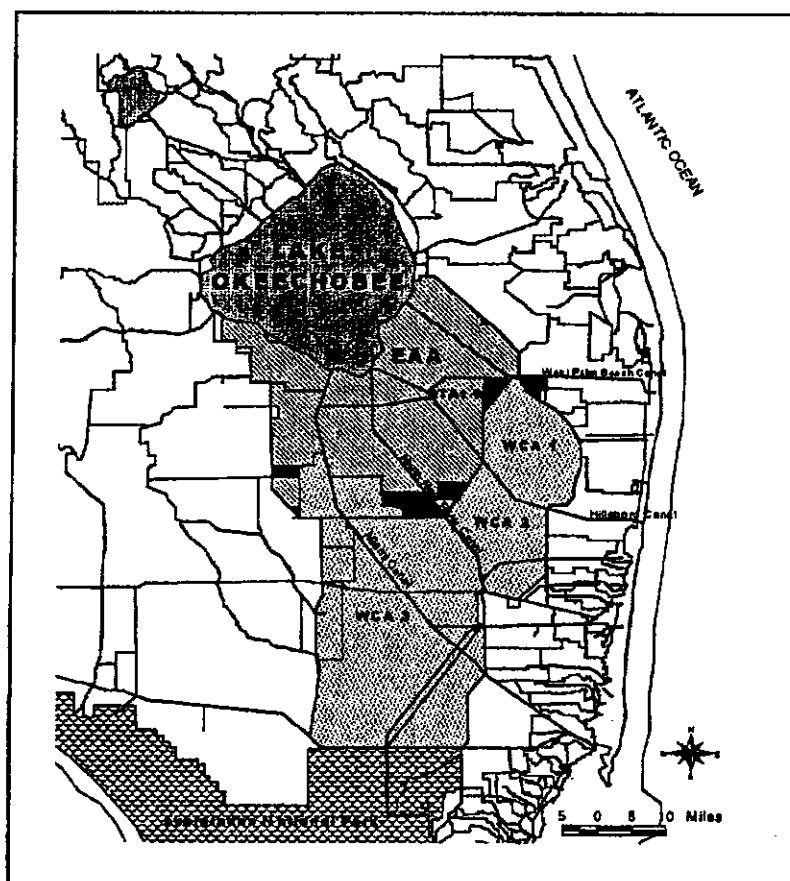


Figure 1. Location of Stormwater Treatment Area 1 West

Table 1. Site characteristics of Storm Water Treatment Area 1 West

Cell	Area ha (ac)	Average Ground Elev. m (ft) NGVD
Cell 1	580 (1,433)	3.13 (10.25)
Cell 2	414 (1,023)	2.94 (9.65)
Cell 3	404 (998)	3.10 (10.18)
Cell 4	146 (361)	3.00 (9.83)
Cell 5	1,228 (3,034)	2.90 (9.50)
Total	2,772 (6,849)	
Average		2.99 (9.79)

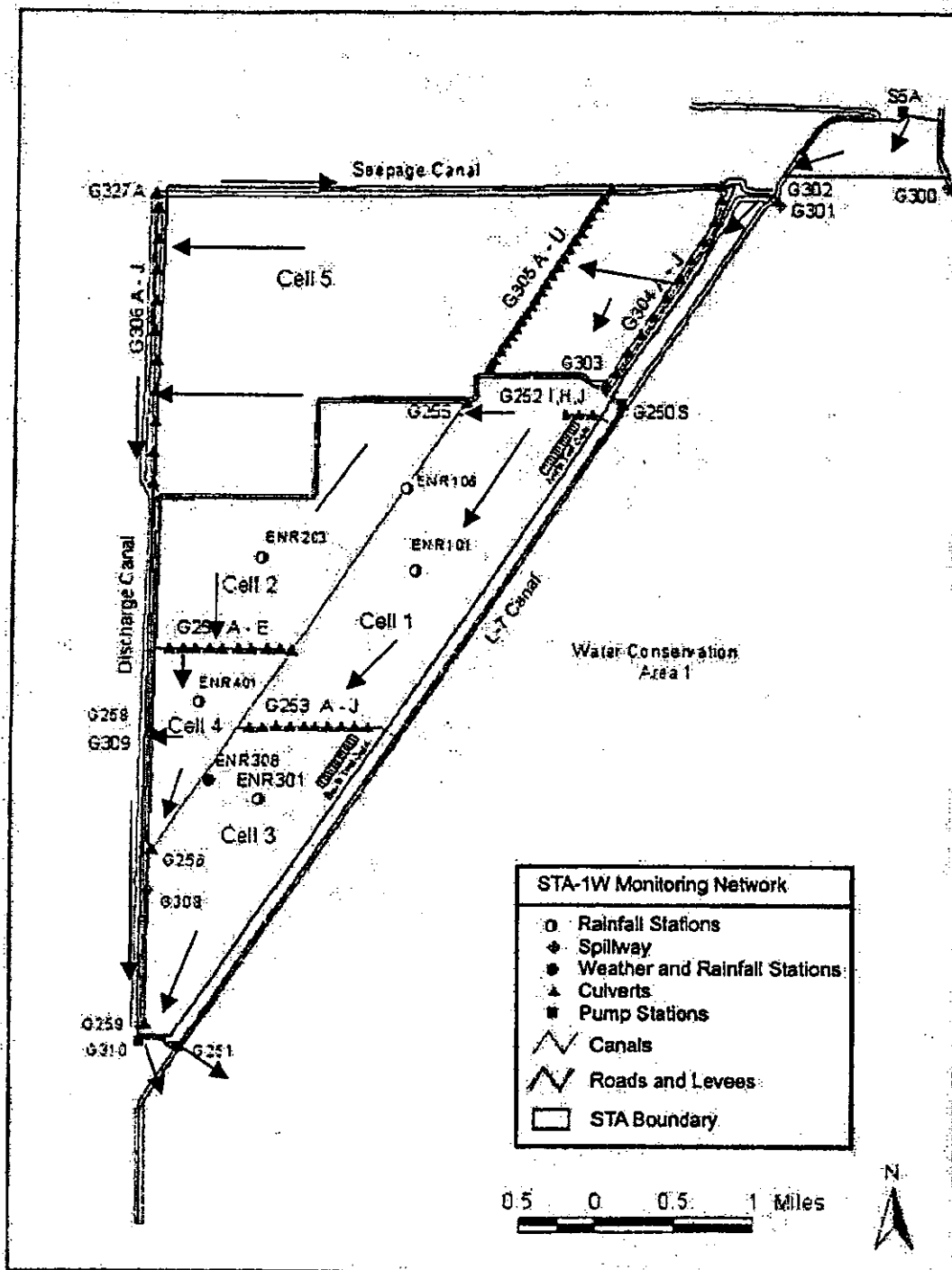


Figure 2 STA-1W structures and monitoring network

Vegetation Cover

STA-1W vegetation cover generally varies from cell to cell but is mainly dominated with cattails (*Typha* sp.) or submerged aquatic vegetation (SAV). Cell 1 is covered mostly with emergent vegetation dominated by cattail (*Typha* sp.), but the cell also contains significant submerged aquatic vegetation. A small portion of Cell 1 contains the floating aquatics water hyacinth (*Eichhorina crassipes*) and water lettuce (*Pistia stratiotes*). Also, leather fern (*Acrostichum* sp.), carolina willow (*Salix caroliniana*) and primrose willow (*Ludwigia* sp.) are present in Cell 1. Cell 2 is mostly covered with emergent vegetation dominated by cattail, but the cell also contains significant submerged aquatic vegetation and periphyton. A small portion of Cell 2 contains the floating aquatics water hyacinth (*Eichhorina crassipes*) and water lettuce (*Pistia stratiotes*). Cell 3 is mostly covered with emergent vegetation dominated by cattail, but also contains significant coverage of pickerelweed (*Pontederia cordata*), arrowhead (*Sagittaria latifolia*), duck potato (*Sagittaria lancifolia*), spikerush (*Eleocharis* sp.) and carolina willow (*Salix caroliniana*). Cell 4 is covered with submerged aquatic vegetation dominated by southern naiad (*Najas guadalupensis*), coontail (*Ceratophyllum demersum*), and pondweed (*Potamogeton illinoensis*) with naturally occurring periphyton. Cell 5A (eastern) is covered with mixed vegetation containing cattail (*Typha* sp.), SAV (*Najas guadalupensis*), the floating aquatics water hyacinth (*Eichhorina crassipes*) and water lettuce (*Pistia stratiotes*). Cell 5B (western) is covered with submerged aquatic vegetation dominated by southern naiad (*Najas guadalupensis*), coontail (*Ceratophyllum demersum*) and hydrilla (*Hydrilla verticillata*) with naturally occurring periphyton. Also, small amounts of cattail (*Typha* spp.) and water hyacinth (*Eichhorina crassipes*) are present (Richard Meeker, South Florida Water Management District, personal communication).

SYSTEM HYDRAULICS AND OPERATION

System Hydraulics

STA-1W Inflow and Distribution

West Palm Beach (C-51) canal water that otherwise would have been pumped into the Loxahatchee National Wildlife Refuge (WCA-1) via the S5A pump station and would have flowed through the Refuge is diverted to STA-1W. A small portion of the area of WCA-1 near the S5A pump station is leveed and forms the STA-1 Inflow and Distribution (STA-1 I & D) that serves as a storage area to divert water into STA-1W and into STA-1E (when it is built). There are two old and four new water control structures in the STA-1 I & D. The S5A pump station delivers water from C-51 (West Palm Beach canal); the S5AS spillway controls WCA-1 inflow and outflow at the junction of L-8 and C-51. The junction has culvert structures S5AW and S5AE. The four new spillway structures are G300, G301, G302 and G311.

G300 is a two-bay, reinforced concrete, U-shaped spillway with vertical lift gates installed on the crest of ogee-shaped weirs. The purpose of this structure is to bypass flows from the STA-1 I & D area into the L-40 borrow canal that runs along the eastern edges of WCA-1. G301 is a three-bay, reinforced concrete, U-shaped spillway with vertical lift gates on weirs. The purpose of this structure is to bypass flow from the STA-1 I & D area into WCA-1 along the L-7 borrow canal on the western edge of WCA-1. G302 is a fixed-crest, concrete ogee spillway equipped with two vertical lift gates each of which are 6 meters (20 ft) wide. The purpose of this structure is to supply inflow to the five cells of STA-1W from the STA-1 I & D area. G302 has a capacity of $92 \text{ m}^3 \text{ s}^{-1}$ (3,250 cfs). G311 is designed as a three-bay, reinforced concrete spillway with lift gates on weirs. The purpose of this structure is to supply water for the future STA-1E from the STA-1 I & D area. Information for STA-1W structures is provided in Table 2. Structure locations are shown in Figure 2.

STA-1W Inflow, Internal, and Discharge Structures

The supply canal to STA-1W is about 2.72 km (1.7 miles) long, extending between the inflow structure G302 and the structure controlling flow into Cells 1, 2, 3 and 4 (G303). The canal has side slopes of 2.5:1, with a bottom width of 18.3 m (60 ft) at elevation -1.52 m (-5 ft) NGVD. Expected velocities in the inflow canal vary between 0.232 m s^{-1} (0.76 ft s^{-1}) and 0.418 m s^{-1} (1.37 ft s^{-1}) (Hutcheon Engineers, 1996). G303 is a two-bay ogee spillway equipped with two lift gates each 4.9 m (16 ft) wide and with a discharge capacity of $50.4 \text{ m}^3 \text{ s}^{-1}$ (1780 cfs).

Perimeter and inter-cell levees facilitate vehicle transportation within the wetland. The levees have culverts underneath for inflows, outflows and inter-cell water delivery. Under each levee, the culverts are spread along the levee to facilitate distribution of flow over the downstream cell area. The evenness of flow distribution depends on the ground surface elevations and vegetation cover of the receiving cell.

Upstream of Cell 1 and Cell 2, there was a buffer cell that received flow from G250S (seepage return pumps) and the inflow spillway G303. There was a levee with 10 culverts (G252A-J) between the buffer cell and Cell 1. The transition to STA-1W involved degrading about 70 percent of the levee and removing all but three of the culverts (G252H, I, J). The number of culverts between the buffer cell and Cell 2 was five (G255A-E) but was increased to seven (G255A-G) in the transition from ENR to STA-1W making direct connection between Cell 1 and Cell 2. Similarly, there were five G254 culverts between Cell 2 and Cell 4 under the ENR Project, but they were increased to nine as part of STA-1W (G254 A, A1, B, B1, C, C1, D, D1, and E). The levee between Cell 1 and Cell 3 has 10 culverts G253 (A-J), which did not change in the transition from ENR to STA-1W. Between Cell 4 and Cell 3 there are five culverts (G256A-E), which were not affected by the change from ENR to STA-1W.

Inflow to Cell 5 is through ten 29.3 m (96 ft) long corrugated metal pipe culverts (G304A-J). The combined capacity of the inflow culverts (G304A-J) is $41.6 \text{ m}^3 \text{ s}^{-1}$ (1,470 cfs). The Florida Power and Light (FPL) levee runs across Cell 5, dividing the cell into two parts. Twenty-two culverts (G305A-V) were constructed to deliver water from the eastern part to the western part of the cell. Each of the G305 culverts is 213 cm (84 inches) in diameter and 27.4 m (90 ft) long, with an invert elevation of 1.07 m (3.5 ft) NGVD. Seepage and recirculated water from Cell 5 is pumped through G250S to Cell 1 through the old ENR buffer cell, which is now part of Cell 1. G250S has three main pumps with a combined capacity of $5.66 \text{ m}^3 \text{ s}^{-1}$ (200 cfs), and three supplemental pumps from the old ENR inflow pump station G250 with a combined capacity of $8.49 \text{ m}^3 \text{ s}^{-1}$ (300 cfs).

At the west end of Cell 3 are two outflow structures releasing to the discharge canal, G308 and G259. Similarly, G258 and G309 are the two outflow structures releasing to the discharge canal from Cell 4, located at the west end. Hydraulic information for internal structures is shown in Table 3.

Outflow from Cell 5 to the discharge canal is through 10 corrugated metal pipes of 183 cm (72 in) in diameter and 39.6 m (130 ft) long with a combined discharge capacity of $41.6 \text{ m}^3 \text{ s}^{-1}$ (1,470 cfs). G327A is a gated culvert 213 cm (84 in) in diameter, and 39.6 m (130 ft) long with $2.83 \text{ m}^3 \text{ s}^{-1}$ (100 cfs) discharge capacity. G327C is a culvert 39.3 m (129 ft) long and with a $2.83 \text{ m}^3 \text{ s}^{-1}$ (100 cfs) discharge capacity. STA-1W outflow structures are the G251 and G310 pump stations. G251 has six identical pumps with a combined capacity of $12.74 \text{ m}^3 \text{ s}^{-1}$ (450 cfs). G310 is equipped with six pumps of three different capacities, with a total capacity of $86 \text{ m}^3 \text{ s}^{-1}$ (3,040 cfs). G310 has two electric pumps with a combined discharge capacity of $5.66 \text{ m}^3 \text{ s}^{-1}$ (200 cfs), two diesel pumps, with a combined discharge capacity of $26.6 \text{ m}^3 \text{ s}^{-1}$ (940 cfs), and two diesel pumps with a combined discharge capacity of $53.8 \text{ m}^3 \text{ s}^{-1}$ (1,900 cfs).

Table 2. Structure information for STA-1W stations

Station	G300	G301	G302	G303	G304	G306	G308	G309	G327A	G310	G251
Type	spillway	spillway	spillway	spillway	culvert	culvert	spillway	spillway	culvert	pump	pump
Units	2	3	2	2	10	10	1	1	1	6	6
Max Q			$92 \text{ m}^3 \text{ s}^{-1}$ (3250 cfs)	$50.4 \text{ m}^3 \text{ s}^{-1}$ (1780 cfs)	$41.6 \text{ m}^3 \text{ s}^{-1}$ (1470 cfs)	$41.6 \text{ m}^3 \text{ s}^{-1}$ (1470 cfs)	$28.3 \text{ m}^3 \text{ s}^{-1}$ (1000 cfs)	$28.3 \text{ m}^3 \text{ s}^{-1}$ (1000 cfs)	$5.7 \text{ m}^3 \text{ s}^{-1}$ (200 cfs)	$86 \text{ m}^3 \text{ s}^{-1}$ (3040 cfs)	$12.7 \text{ m}^3 \text{ s}^{-1}$ (450 cfs)
Min Q	$-28.3 \text{ m}^3 \text{ s}^{-1}$ (-1000 cfs)	$-28.3 \text{ m}^3 \text{ s}^{-1}$ (-1000 cfs)	0	0	0	0	0	0	0	0	0
Design Q			$92 \text{ m}^3 \text{ s}^{-1}$ (3250 cfs)	$50.4 \text{ m}^3 \text{ s}^{-1}$ (1780 cfs)	$41.6 \text{ m}^3 \text{ s}^{-1}$ (1470 cfs)	$41.6 \text{ m}^3 \text{ s}^{-1}$ (1470 cfs)	$15.8 \text{ m}^3 \text{ s}^{-1}$ (560 cfs)	$15.8 \text{ m}^3 \text{ s}^{-1}$ (560 cfs)	$2.83 \text{ m}^3 \text{ s}^{-1}$ (100 cfs)	$86 \text{ m}^3 \text{ s}^{-1}$ (3040 cfs)	$12.7 \text{ m}^3 \text{ s}^{-1}$ (450 cfs)
Design HW	5.79 m (19 ft)	5.79 m (19 ft)	5.49 m (18 ft)	4.79 m (15.7 ft)	4.79 m (15.7 ft)	3.51 m (11.5 ft)	3.58 m (11.75 ft)	3.84 m (12.6 ft)	2.74 m (9 ft)	2.74 m (9 ft)	
Design TW			4.79 m (15.7 ft)	4.41 m (14.46 ft)		2.74 m (9 ft)	2.29 m (7.5 ft)	2.38 m (7.8 ft)	2.65 m (8.7 ft)		
Bypass stage	6.71 m (22 ft)	6.71 m (22 ft)			5.73 m (18.8 ft)	5.73 m (18.8 ft)	5.03 m (16.5 ft)	5.03 m (16.5 ft)	5.33 m (18.8 ft)		
Flow Min. Elevation	3.35 m (11 ft)	2.35 m (7.7 ft)	2.87 m (9.4 ft)		3.43 m 1.52 m (11.25 ft) (5 ft inv.)	2.38 m (7.8 ft) inv.	2.26 m (7.4 ft)	2.32 m (7.6 ft)	0.15 m (0.5 ft)		
Flow Width	6.1 m (20 ft)	6.71 m (22 ft)	6.1 m (20 ft)	4.88 m (16 ft)	1.83 m (6 ft) dia.	1.83 m (6 ft) dia.	4.27 m (14 ft)	4.27 m (14 ft)	2.13 m (7 ft) dia.		0.91 m (3 ft) dia.
Flow Height	2.56 m (8.4 ft)	3.57 m (11.7 ft)					2.04 m (6.7 ft)	2.04 m (6.7 ft)			
RPM										720	200

Table 3. Hydraulic information for STA-1W internal structures and seepage pump stations

Station	G250S	G252	G253	G254	G255	G256	G258	G259	G305
Type	pump	culvert	culvert	culvert	culvert	culvert	culvert	culvert	culvert
Units	6	3	10	9	7	5	1	1	22
Dbkey	JK278	16207, 16235, 16236,	16237, 16238, 16208 to16211, 16247 to16450	16212 to16215, 16251	16731 to 16735	16736 to 16740	15940	15939	Stations not active
Bypass stage		15.5 ft.	15.5 ft.	15.5 ft.	15.5 ft.	15.5 ft.	15 ft.	15 ft.	18.8 ft.
Flow line Elevation		5 ft.	5 ft.	5 ft.	5 ft.	5 ft.	2.5 ft.	1.5 ft.	3.5 ft.
Flow line Length		54.5 ft. barrel	54.5 ft. barrel	54.5 ft. barrel	54.5 ft. barrel	54.5 ft. barrel	78 ft. barrel	78.5 ft.	90 ft.
Cross Section Diameter	3@42 in. 3@36 in propeller	72 inches	72 inches	72 inches	72 inches	72 inches	60 inches	72 inches	84 inches

Discharge from Cell 1 into Cell 3 flows through ten 183-cm (72 in) diameter and 17.7-m (58 ft) long culverts (G253A-J). Discharge from Cell 2 into Cell 4 flows through nine 183-cm (72 in) diameter and 16.5-m (54 ft) long culverts (G252A, A1, B, B1, C, C1, D, D1 and E). Discharge from Cell 3 is to the discharge canal through G308 and G259 and to WCA-1 through the G251 pump station. G308 is a gated weir with a discharge capacity of $15.85 \text{ m}^3 \text{ s}^{-1}$ (560 cfs). G259 is a gated culvert 183 cm (72 in) in diameter and 23.9 m (78.5 ft) long. Discharge from Cell 4 is into the discharge canal through G309, G258 and into Cell 3 through G256A-E. G309 is a gated weir with a discharge capacity of $15.85 \text{ m}^3 \text{ s}^{-1}$ (560 cfs). G258 is a gated culvert 183 cm (72 in) in diameter and 23.5 m (77 ft) long. G256A-E consists of five culverts 183 cm (72 in) in diameter and 16.6 m (54.5 ft) long.

The discharge canal extends between G327A at the northwest corner and the G310 pump station at the southwestern corner. The discharge canal is about 9.12 km (5.7 miles) long with bottom width varying from 15.2 m (50 ft) at G327A to 24.4 m (80 ft) at G308 and to 30.5 m (100 ft) at G259, to account for changes in flow magnitude and ground elevation.

Operation

S5A diverts water from the West Palm Beach canal into the STA-1 I&D area. From the STA-1 I & D area, water flows to STA-1W through spillway G302 or can be bypassed to WCA-1 through G300 and G301 when necessary. Water flows into Cell 5 via the inflow canal and through culverts G304 A-J and into treatment Cells 1, 2, 3 and 4 through gated weir structure G303. The old ENR seepage pumps (G250S) control stages in the seepage canal north of treatment Cell 5 and redirect flow to the old ENR (Cells 1, 2, 3 and 4).

Culverts, installed beneath G302, deliver seepage return flow to G250S pumps. The pumps, in turn, convey the seepage return flow into Cell 1, which also receives inflow from G303, as well. Thus, flow is primarily direct (open surface flow) and partly through the remaining culverts (G252 H, I and J). Cell 2 receives flow from Cell 1 through culverts G255 (A-G). From Cell 1, water flows to Cell 3 through the G253 (A-J) culverts. Water delivery between Cell 2 and Cell 4 is through nine culverts (G254 A, A1, B, B1, C, C1, D, D1 and E). Outflow from STA-1W is through pump stations G251 and G310. One objective of the operation was to maintain stage in Cell 5 at 3.41 m (11.2 ft) NGVD, with a fluctuation of 0.06m (0.2 ft).

HYDROLOGY AND HYDROLOGIC MONITORING

Rainfall

STA-1W has a six-gage rainfall monitoring network. Table 4 lists all the rainfall gaging stations, the corresponding database keys and the respective Thiessen weights. Figure 2 shows the gage locations. Areal average rainfall on the project site was computed as a Thiessen-weighted average of the six-gage network. Minimal data gaps at a station would be estimated, while extended gaps result in areal rainfall computation using remaining stations with a new set of Thiessen weights. The daily distribution of areal average rainfall for the study period (July 1, 2001 to June 30, 2002) is depicted in Figure 3. Monthly summary of areal average rainfall for STA-1W is shown in Table 5. The total areal average rainfall for STA-1W (July 1, 2001 to June 30, 2002) was 138.1 cm (54.4 in). The seven-year average areal rainfall for the previous ENR constructed wetland and the current STA-1W, from July 1, 1994 to June 30, 2001, was 136.1 cm (53.6 inches).

Table 4. Rainfall stations in STA-1W, database retrieval keys and Thiessen weights

Stations	DBKEY	Theissen Weights
ENR101	15851	0.087
ENR106	DU515	0.441
ENR203	15874	0.222
ENR301	15877	0.126
ENR308	15888	0.049
ENR401	15862	0.075

Evapotranspiration

Daily evapotranspiration is computed from high-resolution weather data using a radiation-based evapotranspiration estimation model that was developed based on lysimeter studies in the ENR (Abtew, 1996a, 1996b). A complete weather station is located in Cell 3 (ENR308). The daily distribution of evapotranspiration for STA-1W for the study period (July 1, 2001 to June 30, 2002) is depicted in Figure 3. Monthly summary of evapotranspiration for STA-1W is shown in Table 5. The total evapotranspiration for STA-1W (July 1, 2001 to June 30, 2002) was 133 cm (52.4 inches). The six-year average areal ET for the previous ENR and current STA-1W (July 1, 1995 to June 30, 2000) was 133.3 cm (52.5 inches).

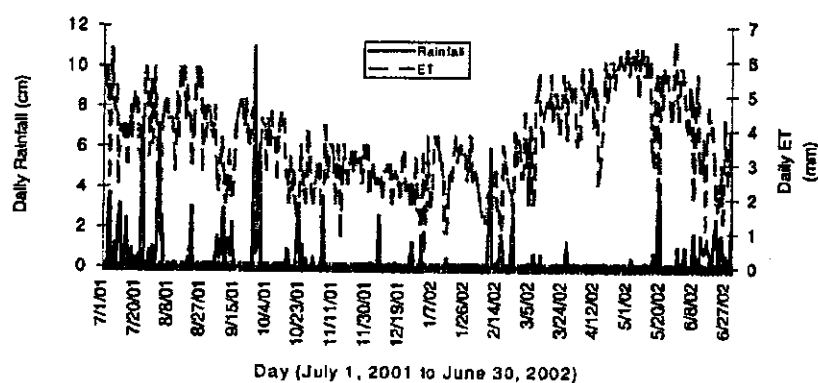


Figure 3. Daily distribution of areal average rainfall and evapotranspiration in STA-1W

Table 5. STA-1W monthly flows, areal weighted rainfall and ET (July 1, 2001 to June 30, 2002)

Year	Month	Inflow G302 ha-m	Outflow G251+G310 ha-m	Rainfall cm (in)	ET cm (in)	Seepage Pump ha-m	Seepage L-7 Culverts ha-m
2001	Jul	4961	5023	25.63(10.09)	13.42(5.28)	0	14
2001	Aug	4189	6045	17.22(6.78)	13.18(5.19)	152	47
2001	Sep	5913	7044	31.78(12.51)	10.04(3.95)	168	37
2001	Oct	4534	6899	8.76(3.45)	9.44(3.71)	180	86
2001	Nov	1836	1662	3.71(1.46)	8.58(3.38)	340	73
2001	Dec	1503	9	5.87(2.31)	7.53(2.96)	75	58
2002	Jan	1890	1603	0.81(0.32)	8.66(3.4)	96	45
2002	Feb	3319	4528	15.06(5.93)	6.45(2.54)	130	39
2002	Mar	297	94	3.35(1.32)	13.57(5.34)	98	28
2002	Apr	9	78	0.3(1.2)	15.04(5.92)	144	7
2002	May	1476	1567	6.51(2.56)	16.39(6.45)	147	0
2002	Jun	6139	7247	19.12(7.53)	10.65(4.19)	186	5

Flows

Database keys for STA-1W flow structures and stage gages are listed in Table 6. The total inflow spillway discharge for the study period (July 1, 2001 to June 30, 2002) was 36,065 ha-m (292,372 ac-ft), and the total outflow through the outflow pump stations was 41,798 ha-m (338,848 ac-ft). The daily pumping rates of the inflow and outflow pumps are shown in Figure 4. Figure 5 shows estimated seepage from the L-7 levee flowing through the roadside culverts and the daily seepage recycling pumping. The total seepage and recirculation pumping was 1,716 ha-m (13,911 ac-ft). The L-7 seepage through the roadside culverts was estimated using a regression equation developed from 42 data points. A relationship was developed between the seepage from L-7 through the roadside culverts, the stage rise in WCA-1 above 4.57 m (15 ft) NGVD, and the difference in stages between WCA-1 and the eastern cells of the ENR (Guardo, 1996). The regression had a coefficient of determination (R^2) of 0.93 and a standard error of $0.30 \text{ m}^3 \text{ s}^{-1}$ (Equation 1). The total estimated seepage from L-7 through the roadside culverts was 439 ha-m (3,559 ac-ft). Monthly flow data for the study period are presented in Table 5.

$$L7a = 0.217 \Delta WCA^{1.311} * \Delta h^{2.025} \quad (1)$$

Where L-7a is seepage in $\text{m}^3 \text{ s}^{-1}$, ΔWCA is rise in stage in WCA-1 above 4.57 m (15 ft) NGVD and Δh is the difference in stage between WCA-1 and the eastern cells of STA-1W.

Water Levels

Daily water levels in each cell of STA-1W depend on rainfall, evapotranspiration, seepage and daily operational decisions. Water levels have been regulated based on water depth, operation status of the S5A pump station and maintenance. The minimum, maximum and mean of the daily average stage observations for the study period are shown in Table 7. The mean observed stage in Cell 1 was 3.75 m (12.3 ft) NGVD. The mean stage in Cell 2 was 3.75 m (12.3 ft) and the mean stage in Cell 3 was 3.66 m (12.00 ft) NGVD. The

mean stage in Cell 4 was 3.70 m (12.15 ft) NGVD, and the mean stage in Cell 5 was 3.47 m (11.38 ft) NGVD. Average daily stages for Cell 5 were computed from stage readings for G304 tailwater and G306 headwater. Average daily water level observations in Cells 1 and 3 of STA-1W and WCA-1 are shown in Figure 6. Water levels for Cells 2 and 4 are shown in Figure 7. Figure 8 shows daily water levels for Cell 5. The mean water depths for Cells 1, 2, 3, 4 and 5 were 62 cm (24.4 in), 81 cm (31.9 in), 56 cm (22.0 in), 70 cm (27.6 in) and 45 cm (22.4 in), respectively.

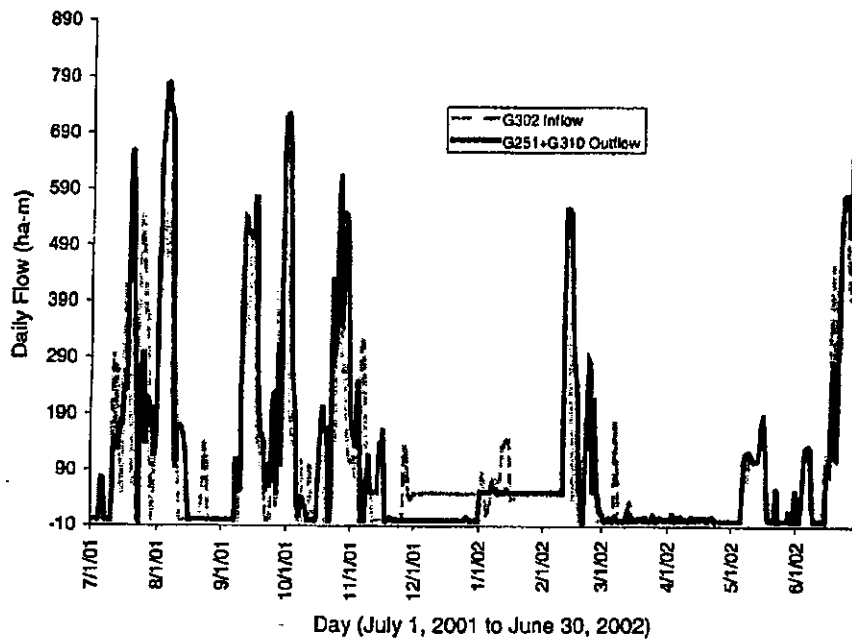


Figure 4. Daily STA-1W inflows and outflows

Table 6. Flow control structures, stage recorders and database retrieval keys used in the water budget analysis for STA-1W

Station	Description	Location	DBKEY	Remark
G302	Spillway	I&D/Supply Canal	JW221	inflow
G250S	Pump	Seepage Canal/Cell 1	JK278	seepage return, recirculation
G251	Pump	Cell 3/WCA-1	JW222	outflow
G310	Pump	Discharge Canal/WCA-1	M2901	outflow
ENR101	Stage	Cell 1	15850	center of cell
ENR203	Stage	Cell 2	15873	center
ENR301	Stage	Cell 3	15876	center
ENR401	Stage	Cell 4	15727	center of cell
G304E_H	Stage	Supply Canal/Cell 5	L9841	Cell 5 stage close to WCA-1
G304E_T	Stage	Supply Canal/Cell 5	L9842	tailwater
G306A_H	Stage	Cell 5/Discharge Canal	L9951	headwater
G306J_H	Stage	Cell 5/Discharge Canal	L9954	headwater
G251_T	Stage	G251 tailwater	16219	WCA-1
G301_T	Stage	Inflow and Distribution/WCA-1	KS686	tailwater

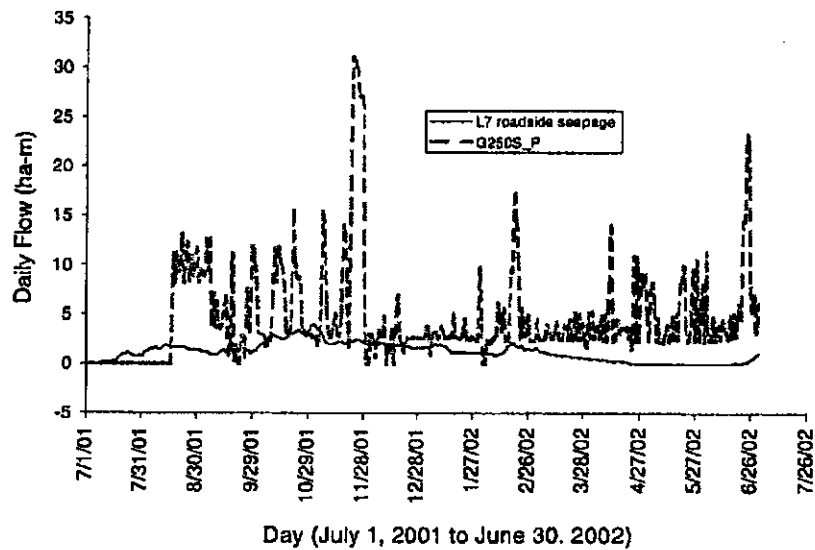


Figure 5. Daily pumping rates of the seepage/recirculation pump and seepage flow through the L-7 levee roadside seepage collection culverts in STA-1W

Table 7. Observed water surface elevations and depths in STA-1W (July 1, 2001 to June 30, 2002)

Cell	Water Surface Elevation			Depth
	Min. m (ft) NGVD	Max. m (ft) NGVD	Mean m (ft) NGVD	Mean cm (in)
Cell 1	3.44 (11.28)	4.42 (14.56)	3.75 (12.3)	62 (24.4)
Cell 2	3.44 (11.28)	4.36 (14.30)	3.75 (12.3)	81 (31.9)
Cell 3	3.35 (10.99)	4.30 (13.97)	3.66 (12.00)	56 (22.0)
Cell 4	3.36 (11.02)	4.18 (14.10)	3.70 (12.14)	70 (27.6)
Cell 5	3.03 (9.94)	3.95 (12.96)	3.47 (11.38)	57 (22.4)

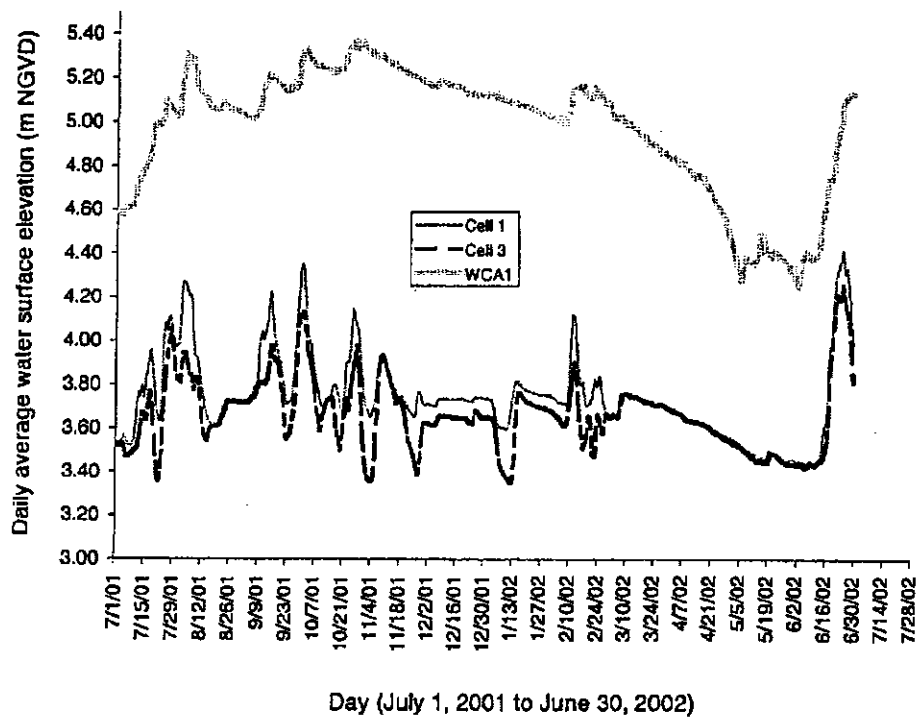


Figure 6. Daily mean water levels in Cell 1 and 3 of STA-1W and Water Conservation Area 1

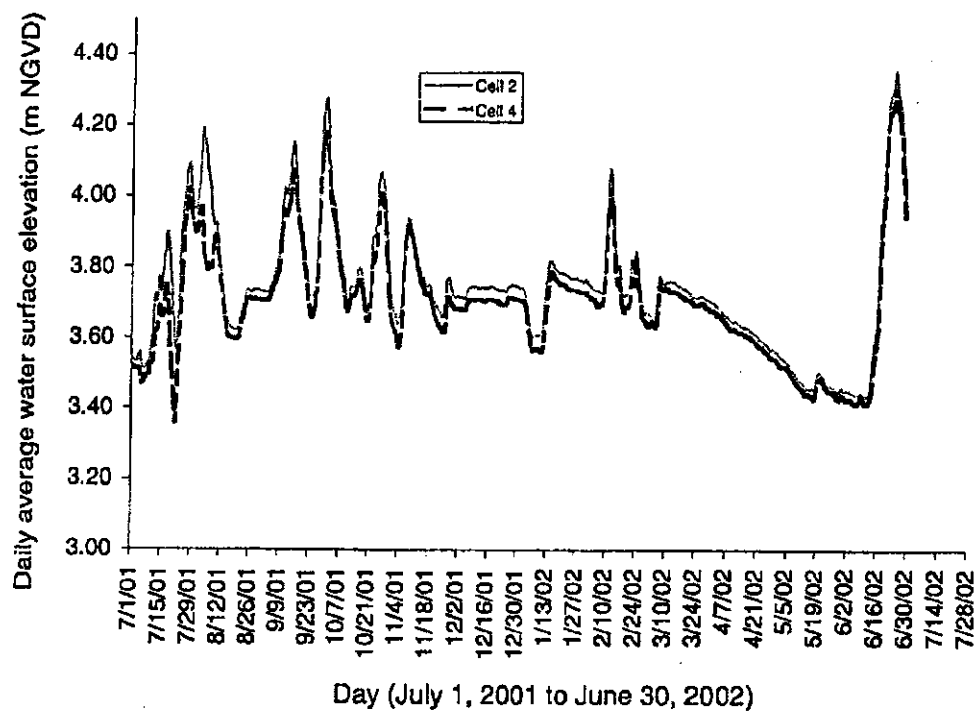


Figure 7. Daily mean water levels in Cells 2 and 4 of STA-1W

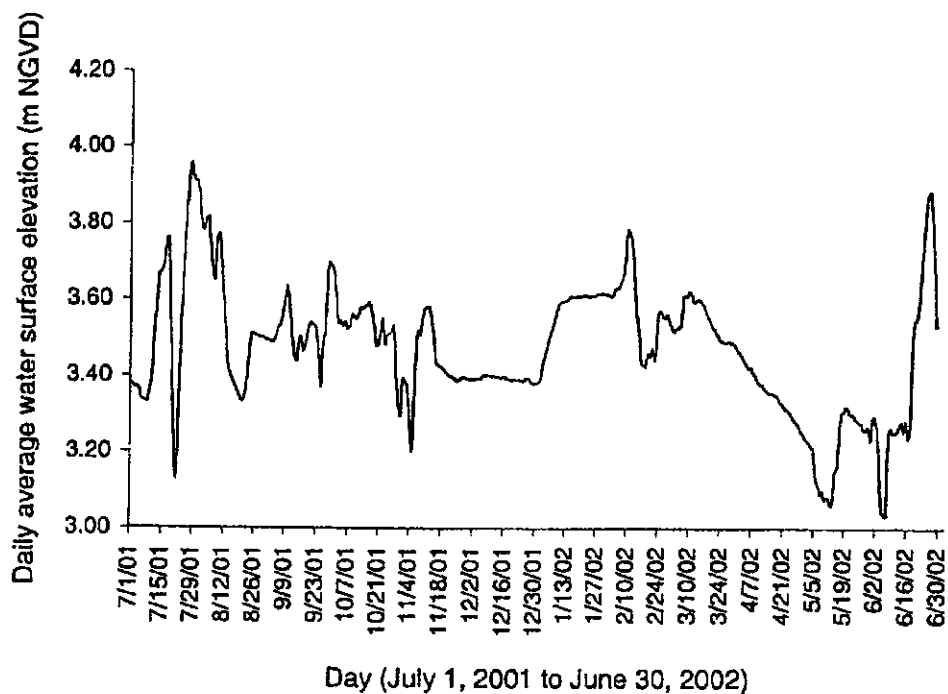


Figure 8. Daily mean water levels in Cell 5 of STA-1W

WATER BUDGET COMPUTATIONS

STA-1W Water Balance Model

A schematic hydrologic model for STA-1W is depicted in Figure 9. The inflow supplied through the G302 spillway accounts for about 78 percent of the known inflow to the system. The known inflows to the system are G302 spillway inflows, rainfall and seepage through the roadside L-7 levee culverts (L-7a). Rainfall accounts for 8.3 percent, and seepage through the roadside culverts (L-7a) accounts for 0.9 percent. Outflow pumping (G251 and G310) accounts for 91.9 percent of the outflows, with evapotranspiration constituting 8.1 percent of the total outflows. The unknowns in the system are ungaged subsurface inflows, outflows and errors that account for 12.8 percent of the total inflows. The schematic model (Figure 9) and the following set of water balance equations represent the hydrologic system of STA-1W for water budget analysis purposes.

$$INFLOW - OUTFLOW = \Delta S + \epsilon_T \quad (2)$$

where INFLOW is the amount of water that enters the system from external sources, and OUTFLOW is water that leaves the system boundary and is not recirculated. ΔS is the change in storage in the system during the time interval of interest. The sum of all errors is represented by ϵ_T . Because all inflow and outflow cannot be entirely quantified, the following equation is introduced to represent the remainders, errors and unknowns:

$$REMAINDERS = \epsilon_T + \text{UNKNOWN} \quad (3)$$

Figure 9 shows the possible inflows and outflows to and from the STA-1W system. The seepage canal, which encompasses the northern side of STA-1W, is designed to capture seepage from STA-1W to the neighboring area and to recirculate discharge from the discharge canal when needed. Seepage through the old ENR supply canal is represented as SEEP1, and seepage in and out of the seepage canal to the north is represented as SEEP2. SEEP3 represents the two seepage possibilities into or out of the discharge canal to the west, regardless of the magnitude. SEEP4 represents the possible seepage loss or gain through the southern levee into the old Knight's Farm or WCA-1. The unmeasured seepage inflow from WCA-1 into STA-1W from the east is represented by L-7b.

In computing the water balance for STA-1W, it is essential to identify quantifiable variables from unquantifiable variables, making reasonable assumptions to reduce the quantity of unknowns as much as possible. Since the purpose of the seepage canal is to recirculate seepage and recycled water, it is assumed that the seepage return pump flows are recirculation in the system. This assumption does not rule out the possibility of external seepage inflow being part of recirculation flow. Change in storage is represented as follows:

$$\Delta S = G302 + R + L7a + L7b - G251 - G310 - ET - SEEP1 - SEEP2 - SEEP3 - SEEP4 + \epsilon_T \quad (4)$$

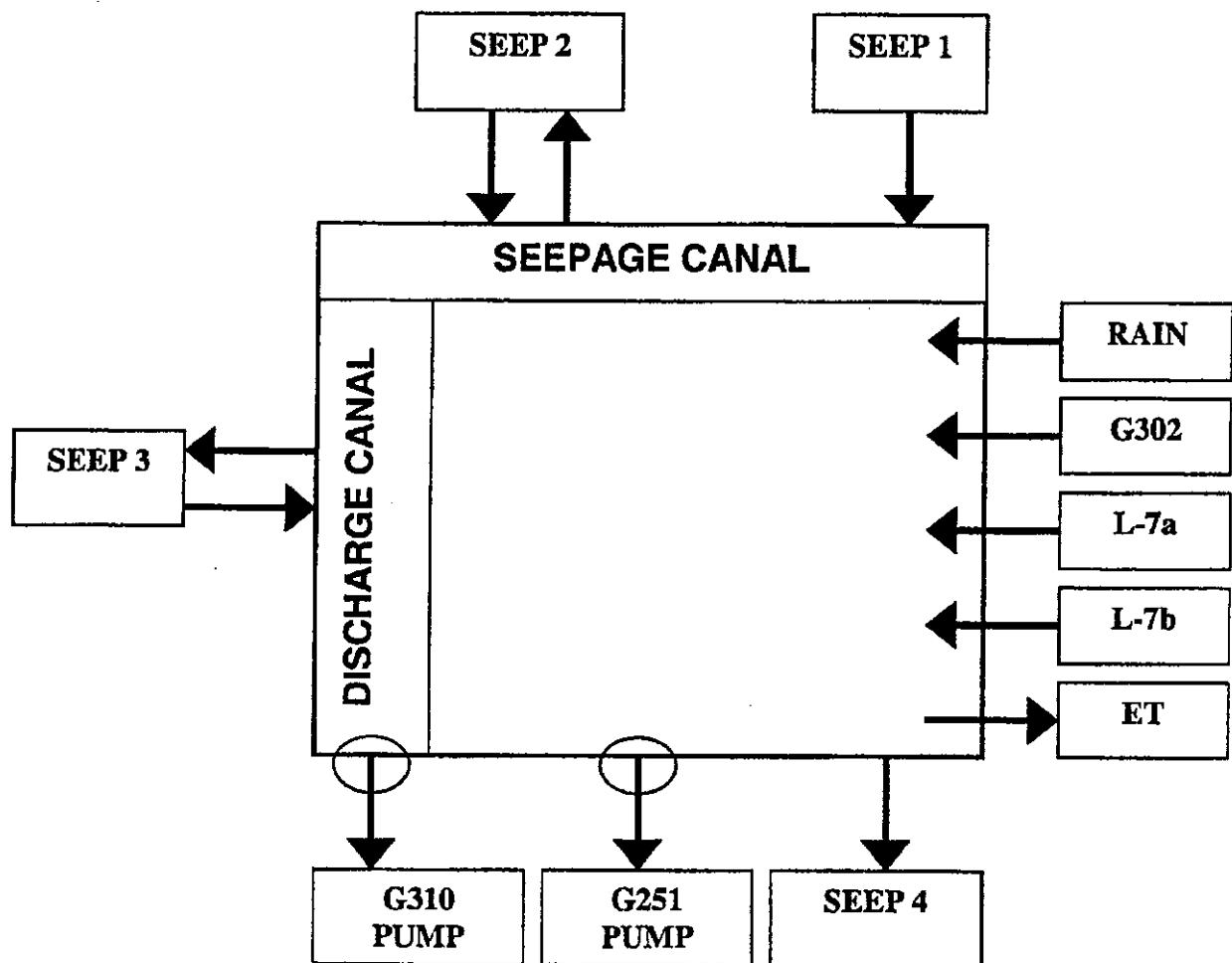


Figure 9. Schematic hydrologic model for STA-1W

where ΔS is change in storage in the system; G302 is inflow; R is rainfall; L-7a is seepage flow from WCA-1 through the roadside culverts; L-7b is unknown subsurface seepage flow from WCA-1 into STA-1W; ET is evapotranspiration losses. G310 and G251 represent outflow pumping; e_T represents total errors in inflow and outflow terms.

Daily change in storage for STA-1W was computed as the sum of storage changes in each of the five cells (Cell 1, Cell 2, Cell 3, Cell 4 and Cell 5). Change in storage volume in each cell was computed from the area of the cell and change in stage. The remainders in the computation of daily water balances are the sum of all errors and unknowns in the system. Daily remainders were computed for the one-year study period based on the following equation:

$$\text{REMAINDERS} = \Delta S - \text{INFLOWS} + \text{OUTFLOWS} \quad (5)$$

Discussion

The total inflow through the inflow spillway was 36,065 ha-m (292,372 ac-ft) and total outflow through the outflow pumps was 41,798 ha-m (338,848 ac-ft). Seepage inflow from the L-7 levee through the roadside culverts was a total of 439 ha-m (3,559 ac-ft). The seepage and recirculation pump had a total flow of 1,716 ha-m (13,911 ac-ft). Total average areal rainfall for the study period was 138.1 cm (54.4 inches) and the total average areal evapotranspiration was 133 cm (52.4 inches). For the study period, the mean daily remainders (errors and unknowns) was 16.3 ha-m per day, or 131.8 ac-ft per day, with the total remainder being 5,935 ha-m (48,114 ac-ft). The standard deviation of the remainders is 85.7 ha-m d⁻¹ (695 ac-ft d⁻¹), which signifies high variation. Figure 10 depicts the daily remainder distribution. The remainder is 12.8 percent of the total inflows. The negative remainder indicates that the overall outflow from the system is higher than the inflow.

Summary of the one-year water budget is shown in Table 8. Details of the water balance terms and calculation results are shown in Appendix I. The mean hydraulic loading rate for the study period, based on average flow, was 3.56 centimeters per day (cm d⁻¹), or 1.40 inches per day (in d⁻¹). The mean hydraulic retention time was computed as the ratio of the mean estimated water volume of STA-1W and the average daily flow rate. The estimated mean volume was computed from the area-weighted (by cell) mean depth of 62 cm (24.4 inches) and a total area of 2,772 ha (6,849 ac). The estimated mean hydraulic retention time was 16.1 days.

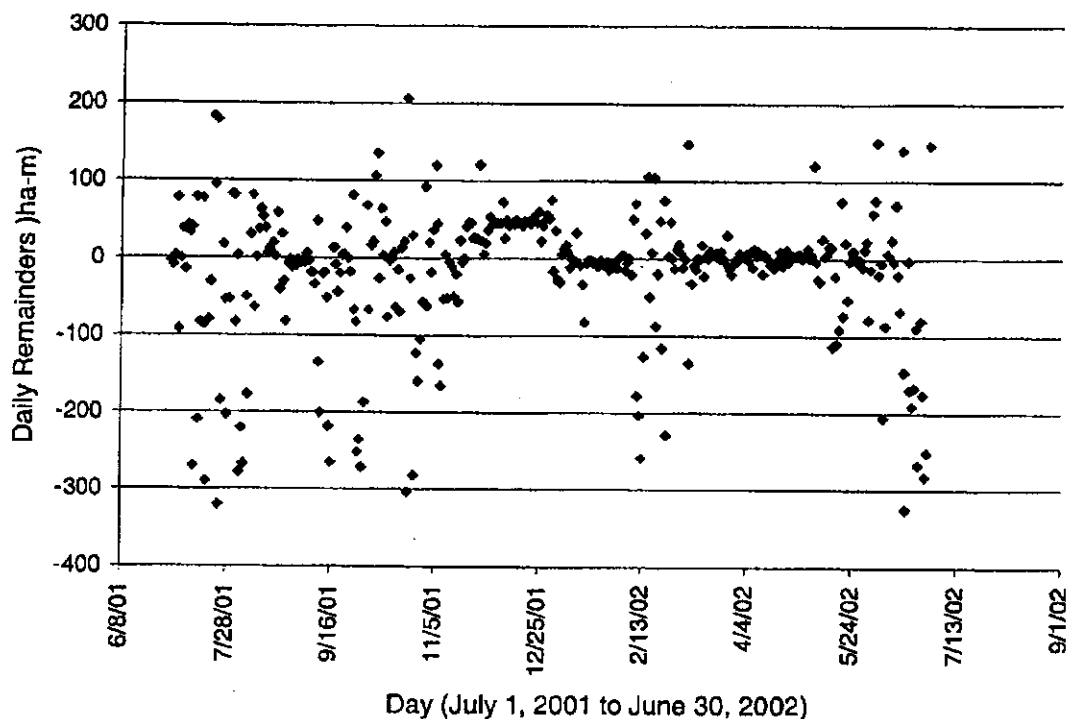


Figure 10. Distribution of daily remainders (errors and unknowns) from STA-1W water balance

WATER BUDGET SUMMARY

This water budget study covers the third year of operation of STA-1W (July 1, 2001 to June 30, 2002). For the period of analysis, the total inflow through the inflow spillway (G302) was 36,065 ha-m, or 292,372 ac-ft. The total outflow through the outflow pump (G251 and G310) was 41,798 ha-m (338,848 ac-ft). Seepage inflow from the L-7 levee through the roadside culverts was 439 ha-m (3,559 ac-ft). The seepage and recirculation pump had a total flow of 1,716 ha-m (13,911 ac-ft). Total areal average rainfall for the study period was 138.1 cm (54.4 in), and the total areal average evapotranspiration was 133 cm (52.4 in). The sum of the errors and unknowns was 5,935 ha-m (48,114 ac-ft), which equates to 12.8 percent of the total inflows to the system and indicates net seepage inflow into STA-1W and or negative errors in flow.

The mean hydraulic loading rate for the one-year period, based on average flow, was 3.56 cm d⁻¹ (1.40 in d⁻¹). The mean hydraulic retention time was computed as the ratio of the estimated mean volume of STA-1W and the average daily flow rate. The estimated mean volume was computed from the area-weighted (by cell) mean depth of 62 cm (24.4 inches) and a total area of 2,772 ha (6,849 ac). The estimated mean hydraulic retention time was 16.1 days. The change in storage was 785 ha-m or 6,364 ac-ft.

In STA-1W, all hydrologic parameters, with the exception of seepage through the system, are well monitored. Since the direction of seepage is not in one direction, the remainders (errors and unknowns) could not be allocated to one variable. Comparison of previous reporting period and current reporting period water budget parameters is depicted in Table 9. The current reporting period surface inflows and outflows are about four times larger than the last reporting period's water budget. The end of the drought

is demonstrated by the increase in flows, which has resulted in a bigger hydraulic loading rate and a smaller detention period.

Table 8. Summary of water budget for STA-1W (July 1, 2001 to June 30, 2002)

INFLOWS	ha-m	Percent of total	OUTFLOWS	ha-m	Percent of total
Spillway Inflow	36,065	78%	Outflow Pump	41,798	91.90%
Rain	3,829	8.30%	ET	3,685	8.10%
L-7 Culverts (L7a)	439	0.90%			
Remainders	5,935	12.80%			
Total	46,268	100%	Total	45,483	100%
Change in Storage	785				
Seepage/Recirculation					
Seepage pump (ha-m)	1,716				
Loading rate (cm/d)	3.56				
Average depth (cm)	62				
Retention time (days)	16.1				

Table 9. Comparison of STA-1W water budget (2001-2002) components to previous years

	July 1, 1999 to June 30, 2000	July 1, 1999 to June 30, 2000	July 1, 1999 to June 30, 2000
INFLOWS (ha-m)			
Spillway Inflow	14,636	8,890	36,065
Rain	2,794	2,890	3,829
L-7 Culverts (L7a)	438	278	439
Remainders	197	1,427	5,935
Total	18,065	13,485	46,268
OUTFLOWS (ha-m)			
Outflow Pump	14,977	9,596	41,798
ET	3,815	3,877	3,685
Total	18,792	13,473	45,483
Change in Storage (ha-m)	-727	12	785
Seepage/Recirculation			
Seepage pump (ha-m)	6,688	2,273	1,716
Loading rate (cm/d)	1.45	0.88	3.56
Average depth (cm)	51.9	49.6	62
Retention time (days)	35	54	16.1

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APPENDIX I

STA-1W Water Balance Terms with Calculated Remainders

Date	Change in Storage	Inflow Spillway G302	Seepage Pump G250S	Outflow Pump G251/G310	Seepage L-7a	Rain	ET	Remainders
	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m
7/1/01	-10.541	0.000	0.000	0.000	0.013	0.000	14.498	-3.944
7/2/01	-8.933	0.000	0.000	0.000	0.007	0.000	16.050	-9.110
7/3/01	-18.162	0.210	0.000	0.000	0.002	0.000	14.498	3.877
7/4/01	16.213	0.000	0.000	0.000	0.006	101.389	7.263	77.918
7/5/01	12.659	0.000	0.000	61.623	0.023	0.000	17.602	-91.862
7/6/01	-86.202	0.000	0.000	73.533	0.038	0.000	13.472	-0.766
7/7/01	-16.102	0.000	0.000	0.000	0.035	34.500	12.446	38.191
7/8/01	-0.530	0.000	0.000	0.000	0.033	0.000	14.498	-13.934
7/9/01	10.262	0.000	0.000	0.000	0.052	59.143	6.736	42.198
7/10/01	79.059	36.446	0.000	0.000	0.114	87.307	11.393	33.415
7/11/01	138.334	292.125	0.000	117.555	0.177	14.786	11.393	39.805
7/12/01	269.041	154.869	0.000	148.104	0.200	2.112	10.367	-270.331
7/13/01	73.573	273.136	0.000	127.090	0.205	16.898	11.393	78.184
7/14/01	206.919	110.131	0.000	171.395	0.214	66.888	8.288	-209.368
7/15/01	-42.371	54.072	0.000	172.366	0.226	3.520	10.894	-83.070
7/16/01	86.905	413.878	0.000	237.940	0.244	0.704	12.945	77.036
7/17/01	189.485	300.777	0.000	233.348	0.257	25.347	10.367	-86.799
7/18/01	95.264	314.402	0.000	497.186	0.356	1.408	13.999	-290.262
7/19/01	-355.454	220.077	0.000	656.470	0.671	13.378	12.945	-79.836
7/20/01	-390.294	61.312	0.000	470.158	0.839	0.704	13.472	-30.480
7/21/01	-427.157	72.484	0.000	324.779	0.973	16.898	9.314	183.419
7/22/01	-144.815	101.455	0.000	143.712	1.001	0.704	8.815	95.249
7/23/01	385.220	360.440	0.000	0.000	1.051	204.186	1.552	178.903
7/24/01	579.772	538.095	0.000	265.040	1.130	0.704	15.551	-320.434
7/25/01	365.778	491.730	0.000	296.869	1.008	1.408	16.050	-184.551
7/26/01	205.685	368.377	0.000	138.244	0.896	6.337	13.999	17.681
7/27/01	223.520	370.711	0.000	215.548	0.814	23.235	8.815	-53.123
7/28/01	109.494	122.492	0.000	201.372	0.737	0.000	15.024	-202.661
7/29/01	-125.689	0.000	0.000	198.284	0.777	28.868	9.841	-52.790
7/30/01	-105.833	107.601	0.000	115.654	0.810	0.000	16.050	82.541
7/31/01	-53.517	196.439	0.000	156.810	0.792	0.000	12.446	81.492
8/1/01	-26.867	270.846	0.000	437.802	0.819	61.960	5.184	-82.494
8/2/01	17.945	474.187	0.000	646.882	1.226	196.441	3.631	3.416
8/3/01	171.871	549.375	0.000	694.316	1.239	42.245	4.657	-277.984
8/4/01	9.579	504.984	0.000	775.392	1.351	70.409	11.920	-220.147
8/5/01	-51.084	470.016	0.000	777.230	1.481	0.000	12.945	-267.594
8/6/01	-161.916	533.427	0.000	732.616	1.479	0.000	13.472	-49.267
8/7/01	-94.323	451.249	0.000	712.025	1.565	0.000	11.920	-176.807
8/8/01	-196.045	222.949	0.000	377.860	1.702	0.000	11.920	30.917
8/9/01	90.950	280.227	0.000	99.349	1.440	1.408	11.920	80.856
8/10/01	19.420	130.544	0.000	165.704	1.421	0.000	9.841	-62.999
8/11/01	-171.348	0.000	0.000	169.014	1.530	5.633	7.762	1.735
8/12/01	-214.593	0.000	0.000	184.784	1.710	0.000	13.999	37.521
8/13/01	-220.651	0.000	0.000	149.460	1.861	0.000	10.367	62.685

Date	Change in Storage	Inflow Spillway G302	Seepage Pump G250S	Outflow Pump G251/G310	Seepage L-7a	Rain	ET	Remainders
	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m
8/14/01	-179.978	0.000	0.000	112.514	1.851	0.000	16.050	53.265
8/15/01	-82.016	0.000	0.000	29.945	1.745	0.000	14.498	39.318
8/16/01	-19.995	0.000	0.005	0.000	1.670	0.000	16.050	5.615
8/17/01	-22.803	0.000	10.937	0.000	1.689	0.000	11.920	12.553
8/18/01	-20.513	0.000	8.104	0.000	1.652	0.000	14.498	7.668
8/19/01	-17.912	0.000	11.228	0.000	1.635	12.674	12.446	19.775
8/20/01	-11.513	0.000	9.273	0.000	1.638	0.704	11.920	1.935
8/21/01	19.393	0.000	10.102	0.000	1.681	84.491	8.288	58.490
8/22/01	88.928	58.828	13.097	0.000	1.778	0.000	11.393	-39.717
8/23/01	91.247	136.612	8.243	0.000	1.691	0.000	16.050	31.007
8/24/01	122.395	105.538	10.411	0.000	1.598	0.000	14.498	-29.758
8/25/01	67.487	0.000	12.241	0.000	1.508	0.000	16.050	-82.029
8/26/01	-6.773	0.000	8.382	0.000	1.426	0.000	15.551	-7.352
8/27/01	-2.940	0.000	10.978	0.000	1.407	1.408	7.762	-2.007
8/28/01	0.443	0.000	8.921	0.000	1.422	0.000	12.945	-11.968
8/29/01	-4.172	0.000	9.726	0.000	1.418	0.000	10.367	-4.778
8/30/01	-2.495	0.000	11.739	0.000	1.382	0.000	12.945	-9.068
8/31/01	-9.252	0.000	8.285	0.000	1.351	0.000	12.446	-1.844
9/1/01	-2.940	0.000	9.457	0.000	1.299	0.000	10.894	-6.654
9/2/01	-5.080	0.000	9.102	0.000	1.269	0.000	10.367	-4.018
9/3/01	-5.419	0.000	8.823	0.000	1.221	0.000	12.945	-6.305
9/4/01	8.449	0.000	12.593	0.000	1.195	21.123	7.762	6.107
9/5/01	41.802	0.000	9.412	0.000	1.103	42.949	6.209	-3.959
9/6/01	49.731	26.168	12.500	0.000	1.009	12.674	8.288	-18.169
9/7/01	29.151	107.323	4.020	106.760	0.963	19.010	10.367	-18.982
9/8/01	55.402	0.000	7.171	52.108	0.926	80.970	7.762	-33.376
9/9/01	85.370	192.742	3.616	56.764	0.908	1.408	5.184	47.740
9/10/01	207.211	468.513	6.339	428.600	0.924	38.725	6.209	-133.858
9/11/01	26.503	332.934	3.756	537.655	1.114	39.429	9.314	-199.996
9/12/01	-131.501	349.799	3.509	513.193	1.284	16.194	5.710	-20.125
9/13/01	-22.423	414.740	4.512	512.165	1.355	80.552	5.710	-18.807
9/14/01	53.013	497.023	6.038	503.017	1.409	14.786	8.288	-51.101
9/15/01	205.773	529.463	6.724	531.648	1.239	0.000	11.393	-218.112
9/16/01	-28.273	291.973	0.883	573.974	1.239	0.000	12.446	-264.934
9/17/01	-189.214	150.275	2.195	314.725	1.336	0.000	12.945	13.153
9/18/01	-49.758	131.643	11.189	177.729	1.264	0.000	13.472	-8.536
9/19/01	-23.291	95.339	0.470	150.578	1.253	0.000	12.945	-43.641
9/20/01	-42.479	88.016	1.943	140.018	1.292	0.000	11.393	-19.624
9/21/01	-70.988	0.000	0.000	54.733	1.269	0.000	13.472	4.052
9/22/01	-112.140	0.000	0.000	97.890	1.329	0.000	10.367	5.211
9/23/01	-112.329	0.000	2.816	64.733	1.383	0.000	9.841	39.138
9/24/01	-92.812	121.567	2.782	203.699	1.429	0.000	12.446	-0.337
9/25/01	-90.572	120.980	0.732	224.765	1.454	7.041	12.945	-17.663

Date	Change In Storage	Inflow Spillway G302	Seepage Pump G250S	Outflow Pump G251/G310	Seepage L-7a	Rain	ET	Remainders
	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m
9/26/01	199.926	34.171	7.565	50.762	1.339	304.166	7.762	81.225
9/27/01	188.035	415.554	4.225	311.540	1.342	19.010	3.105	-66.773
9/28/01	444.884	432.297	3.337	101.061	1.011	33.092	3.105	-82.650
9/29/01	304.617	506.875	11.749	620.907	1.182	169.685	3.631	-251.413
9/30/01	115.753	605.701	10.242	714.890	1.310	0.000	11.920	-235.552
10/1/01	-3.676	457.552	8.375	722.719	1.359	0.000	11.393	-271.525
10/2/01	-203.397	281.022	3.213	661.185	1.671	0.000	11.393	-186.488
10/3/01	-303.479	143.593	3.083	373.985	1.953	0.704	7.762	67.983
10/4/01	-64.347	133.189	2.916	254.487	1.978	0.000	11.920	-86.893
10/5/01	-75.911	141.647	2.929	193.652	2.151	0.000	9.841	16.217
10/6/01	-69.125	0.000	1.791	37.144	2.295	0.000	12.446	21.830
10/7/01	-122.517	0.000	2.031	8.177	2.528	0.000	10.367	106.501
10/8/01	-72.073	106.420	2.540	39.681	2.729	4.225	10.367	135.398
10/9/01	-10.585	0.000	2.386	33.197	2.803	0.704	7.263	-26.368
10/10/01	-92.785	0.000	6.305	21.157	2.979	0.000	10.894	63.714
10/11/01	-13.005	0.000	11.659	0.000	2.873	0.000	12.446	3.432
10/12/01	43.501	99.177	8.226	0.000	2.756	0.000	11.393	47.039
10/13/01	66.725	0.000	11.776	0.000	2.654	0.000	11.920	-75.990
10/14/01	-1.280	0.000	10.521	0.000	2.604	0.000	7.263	-3.378
10/15/01	19.095	0.000	9.772	0.000	2.519	24.643	7.762	0.306
10/16/01	42.950	110.538	8.179	75.386	2.537	18.306	5.184	7.861
10/17/01	-9.904	82.322	3.685	148.755	2.594	0.000	8.815	-62.750
10/18/01	-77.419	112.754	2.899	202.223	2.764	0.704	6.209	-14.791
10/19/01	-84.738	0.000	3.281	159.971	2.947	0.704	7.762	-69.344
10/20/01	-140.427	38.920	4.458	164.103	3.116	0.704	5.184	13.881
10/21/01	9.536	0.000	15.253	0.000	3.074	32.388	4.158	21.768
10/22/01	147.237	265.461	10.883	0.000	3.169	88.715	3.631	208.477
10/23/01	243.289	366.136	8.656	420.086	3.296	0.704	9.841	-303.080
10/24/01	-99.229	141.241	8.808	293.618	3.487	31.684	7.762	-25.738
10/25/01	140.023	569.702	7.991	408.598	3.225	11.265	6.209	29.362
10/26/01	181.228	502.917	3.384	613.814	3.123	11.969	5.184	-282.217
10/27/01	26.967	267.125	3.340	354.800	2.964	0.000	10.894	-122.572
10/28/01	13.082	277.457	3.029	417.387	2.756	0.000	8.815	-159.081
10/29/01	-240.534	200.422	3.051	542.984	3.187	0.000	5.710	-104.551
10/30/01	-292.704	128.895	2.968	492.114	3.597	15.490	5.184	-56.612
10/31/01	-247.309	107.217	2.726	259.608	3.935	0.000	6.736	92.117
11/1/01	-6.850	103.890	2.628	168.402	3.973	0.000	8.288	-61.978
11/2/01	-56.128	112.828	2.706	145.056	3.830	0.000	7.263	20.467
11/3/01	-40.819	77.842	1.952	133.581	3.529	1.408	8.288	-18.270
11/4/01	-121.514	146.162	2.821	248.026	3.336	16.194	2.578	36.602
11/5/01	-73.786	124.944	7.054	160.771	3.209	80.970	2.578	119.560
11/6/01	264.568	317.838	15.294	0.000	2.828	0.000	11.393	44.704
11/7/01	391.231	259.567	12.872	0.000	2.395	0.000	7.263	-136.532

Date	Change in Storage	Inflow Spillway G302	Seepage Pump G250S	Outflow Pump G251/G310	Seepage L-7a	Rain	ET	Remainders
	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m
11/8/01	215.168	121.474	5.735	65.924	2.146	0.000	7.762	-165.234
11/9/01	34.745	105.209	3.134	115.541	2.065	0.000	9.841	-52.854
11/10/01	25.258	88.339	2.689	50.757	2.017	0.000	9.841	4.500
11/11/01	-6.189	0.000	2.995	50.711	2.036	0.000	8.815	-51.301
11/12/01	-47.297	0.000	3.971	50.849	2.052	1.408	5.184	-5.076
11/13/01	-47.490	0.000	5.050	50.578	2.079	0.000	9.841	-10.850
11/14/01	-91.456	0.000	2.975	134.809	2.180	0.000	8.288	-49.461
11/15/01	-99.212	0.000	2.782	119.928	2.220	0.704	2.578	-20.369
11/16/01	-106.631	0.000	4.957	157.647	2.259	0.000	7.762	-56.518
11/17/01	-29.958	0.000	13.917	0.000	2.115	0.704	9.841	22.936
11/18/01	0.380	0.000	13.168	0.000	2.087	0.704	7.762	-5.351
11/19/01	-9.099	0.000	7.634	5.246	2.076	0.704	6.736	-0.103
11/20/01	-50.991	0.000	1.874	3.954	2.155	0.000	8.288	40.904
11/21/01	-53.833	0.000	15.659	0.000	2.210	0.000	9.314	48.529
11/22/01	-51.101	0.000	31.076	0.000	2.281	0.000	7.762	45.620
11/23/01	-32.896	0.000	30.863	0.000	2.328	0.000	9.314	25.910
11/24/01	-32.451	0.000	30.102	0.000	2.365	0.000	8.288	26.528
11/25/01	-31.220	0.000	29.818	0.000	2.384	0.000	8.815	24.788
11/26/01	3.326	130.060	27.078	0.000	2.404	0.000	8.815	120.322
11/27/01	84.370	122.184	27.168	0.000	2.331	0.000	6.736	23.409
11/28/01	31.238	44.219	26.799	0.000	2.254	0.000	9.841	5.395
11/29/01	11.314	37.440	5.004	0.000	2.125	0.000	8.815	19.435
11/30/01	-0.380	44.043	0.000	0.000	2.050	0.000	9.841	36.633
12/1/01	-7.738	48.743	0.000	0.000	2.021	1.408	6.209	53.701
12/2/01	5.495	48.389	2.919	0.000	1.999	6.337	7.263	43.967
12/3/01	-5.478	47.777	2.743	0.000	2.002	0.000	8.288	46.969
12/4/01	-3.458	46.404	2.036	0.000	1.973	1.408	7.263	45.981
12/5/01	-1.231	49.534	0.565	0.000	1.992	0.000	6.736	46.021
12/6/01	1.943	49.468	2.520	0.000	1.973	3.520	7.263	45.756
12/7/01	44.231	49.671	3.462	0.000	2.076	71.817	6.736	72.597
12/8/01	19.076	49.561	2.804	0.000	2.084	0.704	7.263	26.010
12/9/01	-3.727	49.487	3.266	0.000	2.082	0.000	5.710	49.585
12/10/01	1.231	49.162	4.700	0.000	2.062	0.000	7.762	42.231
12/11/01	-1.248	48.968	0.000	0.000	2.029	0.000	7.762	44.483
12/12/01	-4.277	48.973	1.705	0.000	1.999	0.000	8.288	46.961
12/13/01	-1.248	49.057	1.170	0.000	1.988	0.000	8.288	44.004
12/14/01	-4.155	49.140	3.472	0.000	1.972	0.000	5.184	50.083
12/15/01	-2.479	48.927	0.000	0.000	1.942	0.000	7.263	46.085
12/16/01	2.940	48.734	3.124	0.000	1.931	6.337	7.762	46.300
12/17/01	1.246	48.680	6.922	0.000	1.929	0.000	7.263	42.100
12/18/01	-4.454	48.296	2.728	0.000	1.878	0.000	6.736	47.889
12/19/01	-1.248	48.655	2.092	0.000	1.834	0.000	5.710	46.027
12/20/01	-5.434	48.308	1.145	0.000	1.775	0.000	8.815	46.702

Date	Change in Storage	Inflow Spillway G302	Seepage Pump G250S	Outflow Pump G251/G310	Seepage L-7a	Rain	ET	Remainders
	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m
12/21/01	-3.550	48.259	1.997	0.000	1.730	0.000	9.314	44.225
12/22/01	-8.862	48.531	2.616	0.000	1.750	0.000	6.209	52.933
12/23/01	-5.907	47.623	2.513	0.000	1.781	0.000	6.209	49.101
12/24/01	-3.727	47.589	2.557	0.000	1.733	0.000	6.736	46.312
12/25/01	-3.741	47.564	2.664	0.000	1.686	12.674	5.184	60.481
12/26/01	49.223	48.247	2.716	6.134	1.617	34.500	6.736	22.271
12/27/01	0.725	48.486	2.613	2.383	1.636	0.000	5.184	41.831
12/28/01	-9.349	48.225	2.677	0.000	1.651	0.000	8.815	50.410
12/29/01	-11.641	47.549	2.574	0.000	1.656	0.000	4.657	56.190
12/30/01	-6.740	47.415	2.542	0.000	1.598	0.000	4.657	51.096
12/31/01	-3.475	47.867	2.579	0.017	1.629	23.939	1.552	75.341
1/1/02	6.192	47.471	2.767	50.779	1.661	0.704	9.148	-16.282
1/2/02	5.306	86.645	3.819	50.777	1.720	4.929	1.414	35.798
1/3/02	38.474	64.566	2.997	50.789	1.710	0.000	4.213	-27.200
1/4/02	-19.723	8.953	0.900	50.799	1.670	0.000	10.561	-31.015
1/5/02	-45.265	14.414	2.716	50.784	1.792	0.000	5.627	5.059
1/6/02	-34.227	29.698	3.215	50.767	1.983	2.816	4.934	13.024
1/7/02	-16.839	73.015	3.242	68.368	1.981	0.000	6.348	17.118
1/8/02	3.373	73.578	2.875	53.698	1.930	0.000	10.561	7.875
1/9/02	18.008	69.900	2.444	55.626	1.940	0.000	9.868	-11.662
1/10/02	16.124	69.797	3.773	47.050	1.933	0.000	10.561	-2.005
1/11/02	15.333	72.755	3.445	52.365	1.922	0.000	9.148	-2.168
1/12/02	36.858	126.820	2.635	50.490	1.838	0.000	8.455	32.855
1/13/02	86.533	137.486	2.726	50.835	1.666	0.000	7.041	-5.258
1/14/02	98.304	145.318	2.635	55.545	1.509	0.704	2.827	-9.146
1/15/02	134.084	140.857	2.858	50.872	1.297	12.674	2.827	-32.955
1/16/02	64.841	38.565	2.689	50.867	1.166	0.000	6.348	-82.325
1/17/02	-12.698	37.745	5.084	50.884	1.185	0.704	7.734	-6.285
1/18/02	-14.088	41.511	2.767	50.879	1.161	0.000	7.041	-1.161
1/19/02	-12.840	43.596	2.686	50.874	1.197	0.000	9.148	-2.389
1/20/02	-10.199	44.347	2.532	50.882	1.169	0.000	10.561	-5.729
1/21/02	-4.659	48.408	2.598	50.884	1.184	0.000	8.455	-5.090
1/22/02	-1.782	47.921	3.421	50.892	1.141	0.000	9.148	-9.195
1/23/02	-3.887	47.170	4.463	50.889	1.161	0.000	9.868	-8.539
1/24/02	-10.125	47.158	2.476	50.904	1.159	0.000	9.148	-1.609
1/25/02	-5.539	45.756	2.806	50.679	1.102	0.000	9.148	-7.430
1/26/02	-2.197	47.327	2.398	50.848	1.076	0.000	9.148	-9.396
1/27/02	-2.983	49.702	2.672	50.857	1.092	0.000	7.041	-4.121
1/28/02	4.991	47.366	2.537	50.211	1.111	0.000	8.455	-15.180
1/29/02	-4.706	48.318	2.432	50.867	1.112	0.000	10.561	-7.293
1/30/02	-0.443	46.891	2.342	50.865	1.106	0.000	7.041	-9.465
1/31/02	-5.492	46.967	9.740	50.857	1.091	0.000	7.734	-5.041
2/1/02	3.044	46.316	3.829	51.359	1.082	2.112	7.263	-12.155

Date	Change in Storage	Inflow Spillway G302	Seepage Pump G250S	Outflow Pump G251/G310	Seepage L-7a	Rain	ET	Remainders
	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m
2/2/02	-13.169	44.949	0.000	51.383	1.083	0.000	6.736	1.082
2/3/02	-14.387	45.301	0.000	51.405	1.100	0.000	5.710	3.671
2/4/02	-11.891	48.168	2.334	51.415	1.053	0.000	4.657	5.041
2/5/02	7.177	47.023	2.114	51.413	1.001	0.000	4.158	-14.724
2/6/02	-1.538	47.772	2.165	51.202	1.023	0.000	4.158	-5.027
2/7/02	-6.956	47.782	2.398	51.383	1.024	0.000	3.631	0.747
2/8/02	10.312	46.042	2.594	51.408	0.885	0.000	5.710	-20.503
2/9/02	13.456	47.043	2.956	51.445	0.880	73.929	6.209	50.742
2/10/02	129.904	90.548	6.092	49.536	0.942	185.461	6.736	70.775
2/11/02	309.238	516.985	4.832	382.299	1.026	0.704	4.657	-177.478
2/12/02	190.667	550.615	3.293	556.720	1.086	0.000	7.263	-202.948
2/13/02	22.641	316.257	5.645	553.179	1.161	7.041	7.762	-259.123
2/14/02	-223.240	192.534	2.383	541.717	1.425	2.816	4.657	-126.358
2/15/02	-348.772	38.213	2.337	365.025	1.721	14.082	4.657	33.106
2/16/02	-168.745	158.398	2.598	267.773	1.855	45.766	1.026	105.965
2/17/02	-131.720	64.390	9.603	237.121	2.145	0.000	9.841	-48.708
2/18/02	-79.528	0.000	9.214	65.136	2.025	0.000	8.815	7.602
2/19/02	-18.205	113.951	17.034	22.086	2.019	0.000	7.263	104.826
2/20/02	82.105	0.000	14.729	0.000	1.820	0.000	6.736	-87.021
2/21/02	-8.295	106.469	10.445	129.874	1.717	0.000	8.209	-19.603
2/22/02	-1.004	247.492	2.581	230.970	1.775	35.204	6.209	48.297
2/23/02	36.554	129.500	5.635	278.556	1.916	70.409	2.079	-115.364
2/24/02	94.518	231.021	2.811	52.081	1.473	0.000	10.894	75.001
2/25/02	148.330	141.789	2.978	215.457	1.446	0.000	8.288	-228.841
2/26/02	-81.770	0.000	4.940	69.528	1.509	0.000	10.367	3.383
2/27/02	-89.971	0.000	2.346	34.002	1.508	0.000	9.841	47.636
2/28/02	-20.728	0.000	2.359	14.717	1.398	0.000	7.263	0.147
3/1/02	-2.440	0.000	2.285	9.212	1.458	0.000	7.263	-12.576
3/2/02	-23.356	0.000	2.452	0.000	1.599	0.000	12.446	12.508
3/3/02	-26.166	0.000	4.522	0.000	1.558	0.000	9.314	18.410
3/4/02	-10.774	0.000	2.660	6.024	1.389	6.337	5.184	7.272
3/5/02	1.187	0.000	2.427	0.000	1.230	0.000	11.393	-11.350
3/6/02	-3.054	0.000	2.393	0.000	1.255	0.000	5.184	-0.875
3/7/02	34.140	175.674	2.422	8.245	1.240	18.306	5.184	147.651
3/8/02	210.068	86.978	2.828	0.000	1.161	0.704	13.472	-134.699
3/9/02	18.613	0.000	4.032	0.000	1.083	0.000	13.999	-31.529
3/10/02	-5.984	0.000	3.117	0.000	0.984	0.000	15.551	-8.583
3/11/02	21.354	0.000	2.520	0.000	0.941	18.308	11.393	-13.500
3/12/02	-12.800	0.000	2.620	7.127	0.979	4.225	9.841	1.035
3/13/02	-28.275	0.000	3.332	17.430	0.932	0.000	12.446	-0.670
3/14/02	4.365	34.344	4.265	0.000	0.869	0.000	12.945	17.904
3/15/02	3.729	0.000	2.501	6.293	0.872	0.000	13.472	-22.622
3/16/02	-16.469	0.000	2.456	0.000	0.847	0.000	12.945	4.371

Date	Change in Storage	Inflow Spillway G302	Seepage Pump G250S	Outflow Pump G251/G310	Seepage L-7a	Rain	ET	Remainders
	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m
3/17/02	-14.687	0.000	2.523	0.000	0.806	0.000	15.551	-0.058
3/18/02	-26.865	0.000	3.729	5.256	0.790	0.000	11.920	10.480
3/19/02	-23.421	0.000	3.910	3.765	0.787	0.000	13.999	6.444
3/20/02	-20.107	0.000	2.461	0.000	0.780	0.000	13.999	6.888
3/21/02	-25.914	0.000	4.573	6.638	0.736	0.000	12.446	7.566
3/22/02	-12.314	0.000	2.816	1.556	0.661	0.000	10.894	0.525
3/23/02	-21.935	0.000	2.432	0.000	0.670	0.000	12.945	9.660
3/24/02	-15.086	0.000	5.172	0.000	0.680	0.000	15.551	0.214
3/25/02	-19.662	0.000	2.471	10.991	0.671	0.000	14.498	-5.155
3/26/02	-4.960	0.000	5.038	0.000	0.642	35.204	10.367	30.440
3/27/02	8.134	0.007	2.456	0.000	0.581	9.857	15.024	-12.712
3/28/02	-0.014	0.000	4.057	6.175	0.539	0.000	14.498	-20.120
3/29/02	-8.150	0.000	2.466	2.792	0.557	0.000	13.472	-7.556
3/30/02	-12.621	0.000	1.764	0.000	0.548	0.000	14.498	-1.328
3/31/02	-13.944	0.000	5.150	2.704	0.515	0.000	14.498	-2.742
4/1/02	-18.339	0.000	2.608	2.452	0.473	0.000	9.841	6.520
4/2/02	-13.515	0.000	5.312	0.886	0.468	0.000	10.894	2.204
4/3/02	-22.616	0.000	2.613	12.131	0.474	2.112	10.367	2.704
4/4/02	-21.919	0.000	3.565	0.000	0.489	0.000	16.050	6.358
4/5/02	-18.965	0.000	3.819	6.783	0.432	0.000	14.498	-1.864
4/6/02	-22.899	0.000	2.620	0.000	0.414	0.000	13.999	9.314
4/7/02	-8.671	0.000	4.842	7.316	0.430	0.000	12.945	-11.161
4/8/02	-26.060	0.000	2.285	0.000	0.436	0.000	13.999	12.497
4/9/02	-23.014	0.000	5.016	3.533	0.421	0.000	16.050	3.853
4/10/02	-24.384	0.000	2.356	0.000	0.370	0.000	15.024	9.730
4/11/02	-18.520	0.000	8.059	0.000	0.326	0.000	11.393	7.452
4/12/02	-1.294	0.000	13.941	7.355	0.314	0.704	14.498	-19.540
4/13/02	-19.617	0.000	2.290	0.000	0.265	0.000	13.999	5.883
4/14/02	-9.191	0.000	2.520	4.844	0.258	2.816	6.736	0.684
4/15/02	-8.465	0.000	4.490	5.554	0.289	2.816	7.762	-1.745
4/16/02	-4.277	0.000	3.073	2.488	0.290	0.000	9.841	-7.761
4/17/02	-5.137	0.000	3.606	5.395	0.281	0.000	11.920	-11.897
4/18/02	-13.438	0.000	3.624	3.863	0.242	0.000	16.577	-6.761
4/19/02	-16.914	0.000	3.430	4.570	0.202	0.000	13.472	-0.926
4/20/02	-23.120	0.000	3.729	0.000	0.169	0.000	14.498	8.792
4/21/02	-12.621	0.000	2.557	4.676	0.141	0.000	16.577	-8.491
4/22/02	-20.625	2.686	3.680	6.511	0.111	0.000	16.577	0.335
4/23/02	-21.175	4.199	1.649	0.000	0.067	0.000	14.498	10.944
4/24/02	-9.772	2.310	10.885	0.000	0.043	0.000	16.050	-3.926
4/25/02	-22.334	0.000	2.319	0.000	0.039	0.000	16.050	6.322
4/26/02	-19.662	0.000	10.836	0.000	0.018	0.000	17.103	2.576
4/27/02	-19.393	0.000	2.344	0.000	0.005	0.000	16.577	2.822
4/28/02	-19.838	0.000	8.977	0.000	0.000	0.000	16.050	3.789

Date	Change in Storage	Inflow Spillway G302	Seepage Pump G250S	Outflow Pump G251/G310	Seepage L-7a	Rain	ET	Remainders
	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m
4/29/02	-22.143	0.000	7.900	0.000	0.000	0.000	16.050	6.093
4/30/02	-17.717	0.000	8.882	0.000	0.000	0.000	17.103	0.614
5/1/02	-18.859	0.000	4.982	0.000	0.000	0.000	17.602	1.257
5/2/02	-21.084	0.000	2.373	0.000	0.000	0.000	15.551	5.533
5/3/02	-18.160	0.000	7.832	0.000	0.000	12.058	17.103	13.115
5/4/02	-17.258	0.000	8.265	0.000	0.000	0.000	17.103	0.155
5/5/02	-20.196	0.000	5.552	0.000	0.000	0.000	16.050	4.146
5/6/02	-98.471	103.971	2.327	64.972	0.000	0.000	17.602	119.867
5/7/02	-38.551	79.836	4.690	108.323	0.000	0.000	13.999	-3.935
5/8/02	-38.553	72.408	2.214	120.503	0.000	0.000	16.577	-26.118
5/9/02	-2.890	107.093	2.192	121.477	0.000	0.000	17.602	-29.097
5/10/02	-39.799	115.225	2.195	114.115	0.000	0.000	15.551	25.359
5/11/02	-4.420	114.107	2.961	107.198	0.000	6.839	15.551	2.618
5/12/02	-14.403	115.468	3.976	107.376	0.000	0.000	17.103	5.391
5/13/02	-32.315	107.577	2.288	108.844	0.000	0.000	15.551	15.497
5/14/02	0.140	164.118	2.508	134.053	0.000	1.415	16.577	14.764
5/15/02	85.486	157.749	4.774	174.737	0.000	0.000	9.841	-112.294
5/16/02	17.776	169.599	2.510	186.068	0.000	20.585	8.288	-21.948
5/17/02	92.373	89.983	5.055	91.779	0.000	0.000	14.498	-108.666
5/18/02	72.504	0.000	2.405	3.367	0.000	0.000	15.551	-91.421
5/19/02	23.579	0.000	7.993	0.000	0.000	101.111	3.631	73.901
5/20/02	58.172	0.000	8.387	0.000	0.000	0.251	15.551	-73.472
5/21/02	-4.818	28.776	9.824	0.000	0.000	0.000	12.945	20.648
5/22/02	-18.406	0.000	3.959	55.401	0.000	0.000	16.050	-53.045
5/23/02	-12.054	0.000	2.300	0.000	0.000	0.000	15.024	-2.970
5/24/02	-24.545	0.000	2.439	0.000	0.000	0.000	15.551	8.994
5/25/02	-23.029	0.000	4.747	0.000	0.000	0.000	13.472	9.557
5/26/02	-12.220	0.000	9.576	0.000	0.000	0.522	11.920	0.823
5/27/02	-5.954	0.000	2.337	0.000	0.000	1.071	12.446	-5.421
5/28/02	-32.406	0.000	10.572	16.899	0.000	0.000	17.103	-1.596
5/29/02	-8.089	0.000	2.486	0.000	0.000	0.000	18.129	-10.039
5/30/02	4.119	0.169	5.706	0.000	0.000	29.014	12.945	12.119
5/31/02	-29.578	49.499	7.966	52.311	0.000	7.513	11.920	22.360
6/1/02	62.636	0.000	2.266	0.000	0.000	0.000	16.050	-78.686
6/2/02	-2.357	0.000	11.397	0.000	0.000	0.000	16.050	-13.693
6/3/02	-39.925	45.888	3.817	40.743	0.000	27.670	13.999	58.741
6/4/02	-98.879	94.101	2.381	106.107	0.000	0.000	11.393	75.480
6/5/02	-166.096	123.322	2.359	128.061	0.000	0.000	10.894	150.462
6/6/02	-15.636	111.489	4.786	132.560	0.000	0.000	14.498	-19.932
6/7/02	-13.423	120.731	2.371	126.940	0.000	0.955	13.472	-5.303
6/8/02	224.613	0.000	3.181	21.773	0.000	46.797	5.710	-205.300
6/9/02	74.688	0.000	3.893	0.000	0.000	1.759	13.472	-86.401
6/10/02	-20.566	0.000	2.430	0.000	0.000	1.533	15.551	6.548

Date	Change in Storage	Inflow Spillway G302	Seepage Pump G250S	Outflow Pump G251/G310	Seepage L-7a	Rain	ET	Remainders
	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m
6/11/02	-9.307	0.000	4.446	0.000	0.000	2.311	8.288	3.329
6/12/02	11.731	0.000	3.396	0.000	0.000	43.887	7.762	24.395
6/13/02	34.316	8.522	3.024	0.000	0.000	29.918	8.288	-4.165
6/14/02	48.112	107.528	2.479	0.000	0.000	20.296	10.367	69.345
6/15/02	62.283	119.867	4.874	98.590	0.003	23.211	3.105	-20.897
6/16/02	99.842	89.053	2.682	87.020	0.022	39.617	9.841	-68.010
6/17/02	18.522	338.062	5.050	185.918	0.077	19.610	12.945	140.364
6/18/02	305.952	453.584	2.731	283.236	0.130	0.480	10.894	-145.889
6/19/02	420.870	209.593	4.531	112.786	0.084	10.837	11.393	-324.535
6/20/02	224.831	405.912	6.136	217.662	0.085	42.739	8.815	-2.572
6/21/02	264.266	425.495	4.846	391.973	0.122	66.942	5.184	-168.862
6/22/02	198.181	527.675	14.387	523.016	0.161	7.733	4.657	-190.285
6/23/02	99.493	510.457	14.416	578.155	0.208	6.985	6.209	-166.208
6/24/02	140.230	582.288	23.280	567.113	0.251	43.883	8.288	-89.210
6/25/02	173.027	469.299	21.600	579.748	0.365	19.384	3.631	-267.358
6/26/02	-47.433	394.471	7.788	510.829	0.492	0.000	11.920	-80.353
6/27/02	-11.899	457.814	5.260	654.153	0.534	16.123	7.762	-175.544
6/28/02	-170.464	227.848	6.988	679.491	0.671	4.919	6.736	-282.325
6/29/02	-341.516	72.858	3.151	655.626	0.864	0.000	10.894	-251.281
6/30/02	-422.617	242.746	6.122	565.234	1.044	52.505	7.263	146.415

